1. A voltage regulator having an input terminal to be coupled to an input voltage source and an output terminal to be coupled to a load, comprising:

a switching circuit to intermittently couple the input terminal and the output terminal in response to a digital control signal;

a filter to provide a generally DC output voltage at the output terminal;

a current sensor to generate a digital first feedback signal representing the current passing through the switching circuit;

a voltage sensor to generate a second feedback signal representing the output voltage; and

a digital controller which receives and uses the digital feedback signal to generate the digital control signal, the digital controller configured to maintain the output voltage at the output terminal at a substantially constant level.

2. The voltage regulator of claim 1, wherein the switching circuit includes a rectifier to at least intermittently couple the output terminal to ground.

3. The voltage regulator of claim 1, wherein the switching circuit, filter and current sensor are fabricated on a first IC chip, and the digital controller is fabricated on a second, separate IC chip.

4. The voltage regulator of claim 1, wherein the digital feedback signal indicates whether the current exceeds a threshold current.

5. The voltage regulator of claim 4, wherein the current sensor generates a plurality digital feedback signals, each signal representing whether the current has exceeded a different threshold current.

6. The voltage regulator of claim 4, wherein the current sensor generates a plurality digital feedback signals, each signal representing whether the current has crossed a different threshold current.

7. The voltage regulator of claim 4, further comprising a fault protection circuit to override the digital control signal and open the switching circuit if the current passing through the switching circuit exceeds a safety limit, the safety limit being larger than the threshold current.

8. The voltage regulator of claim 7, wherein the fault protection circuit generates a second digital feedback signal which is received by the digital controller if the current exceeds the safety limit.

9. The voltage regulator of claim 4, wherein the switching circuit includes a first transistor to couple the output terminal to the input terminal and a second transistor to couple the output terminal to ground.

10. The voltage regulator of claim 9, wherein the current sensor includes a first sensor to generate a first digital feedback signal on a first feedback line indicating the current passing through the first transistor and a second sensor to generate a second digital feedback signal on a second line representing the current passing through the second transistor.

11. The voltage regulator of claim 10, wherein the first and second feedback lines are coupled to a third feedback line which is coupled to the digital controller, and the digital controller includes logic to determine which transistor is represented by the signal on the third feedback line.

12. The voltage regulator of claim 9, further comprising an interpreter located on the slave which receives the digital control signal and converts the digital control signal into a command to switch the first and second transistors.

13. The voltage regulator of claim 12, wherein the digital control signal generated by the digital controller includes a first control signal on a first control line and a second control signal on a second line, and the interpreter converts the first control signal into a command to open the

first transistor and close the second transistor and converts the second control signal into a second command to close the first transistor and open the second transistor.

14. The voltage regulator of claim 13, wherein the digital control signal generated by the digital controller includes a third control signal on a third control line, and the interpreter converts the third control signal into a command to open the first and second transistors.

15. The voltage regulator of claim 14, wherein the interpreter converts the third control signal into a command to open the first and second transistors if the second transistor is closed and the current falls below zero.

16. The voltage regulator of claim 1, further comprising a state sensor to generate a digital state signal indicating the state of the switching regulator which is received by the digital controller.

17. The voltage regulator of claim 1, wherein the slave includes an interpreter which receives the digital control signal and converts the digital control signal into a command to switch the switching circuit.

18. A voltage regulator having an input terminal to be coupled to an input voltage source and an output terminal to be coupled to a load, comprising:

a) a plurality of slaves, each slave including

i) a switching circuit to intermittently couple the input terminal and the output terminal in response to a digital control signal,

ii) a filter to provide a generally DC output voltage at the output terminal;

iii) a current sensor to generate a digital feedback signal representing the current passing through the switching circuit; and

b) a digital controller which receives and uses the digital feedback signals from the slave plurality of slaves to generate a plurality of digital control signals, the digital controller configured to maintain the output voltage at the output terminal at a substantially constant level.

19. A method of operating a voltage regulator having an input terminal to be coupled to an input voltage source and an output terminal to be coupled to a load, comprising:

intermittently coupling the input terminal and the output terminal with a switching circuit in response to a digital control signal;

filtering an output of the switching circuit to provide a generally DC output voltage at the output terminal;

generating a digital feedback signal representing the current passing through the switching circuit with a current sensor; and

receiving and using the digital feedback signal from the slave in a digital controller to generate the digital control signal, the digital controller configured to maintain the output voltage at the output terminal at a substantially constant level.

20. A voltage regulator having an input terminal to be coupled to an input voltage source and an output terminal to be coupled to a load, comprising:

a switching circuit to intermittently couple the input terminal and the output terminal in response to a control signal;

a filter to provide a generally DC output voltage at the output terminal; and

a digital controller which operates at a clock frequency f_{clock} which is significantly faster than a desired switching frequency f_{switch} of the switching circuit, wherein each clock cycle the digital controller receiving a first digital feedback signal derived from an output voltage at the output terminal and a second digital feedback signal derived from a current passing through the switching circuit, and generates the control signal to control the switching circuit so that the output voltage is maintained at a substantially constant level.

21. The voltage regulator of claim 20, further comprising a current sensor to generate the first digital feedback signal.

22. The voltage regulator of claim 21, further comprising a voltage sensor to generate the second digital feedback signal.

23. The voltage regulator of claim 22, wherein the voltage sensor includes an analog-to-digital converter.

24. The voltage regulator of claim 23, wherein the voltage sensor further includes a voltage sampler.

25. The voltage regulator of claim 22, wherein the switching circuit, filter and current sensor are fabricated on a first IC chip and the digital controller and voltage sensor are fabricated on a second, different IC chip.

26. The voltage regulator of claim 22, wherein the switching circuit, filter and current sensor are fabricated on a first IC chip, the voltage sensor is fabricated on a second IC chip, and the digital controller is fabricated on a third IC chip.

27. The voltage regulator of claim 20, wherein the first digital feedback signal represents the difference between the output voltage and a nominal voltage.

28. The voltage regulator of claim 20, wherein the first digital feedback signal represents the difference between the output voltage in a current clock cycle and an output voltage in a previous clock cycle.

29. The voltage regulator of claim 20, wherein each clock cycle the digital controller receives a third digital feedback signal derived from an output voltage at the output terminal.

30. The voltage regulator of claim 29, wherein the first digital feedback signal is equal to the difference between the output voltage and a nominal voltage, and the third digital feedback signal is equal to the difference between the output voltage in a current clock cycle and an output voltage in a previous clock cycle.

31. The voltage regulator of claim 20, wherein the first digital feedback signal is the output voltage.

32. The voltage regulator of claim 20, wherein digital controller is coupled to the output terminal, and the controller includes a sampling circuit to capture a difference between the output voltage and a reference voltage, the digital controller further including an analog-to-digital converter to convert the charge held by the sampling circuit into a digital signal.

33. The voltage regulator of claim 32, wherein the reference voltage is ground.

34. The voltage regulator of claim 32, wherein the reference voltage is a nominal voltage.

35. The voltage regulator of claim 32, wherein the reference voltage is an output voltage from a previous clock cycle.

36. The voltage regulator of claim 20, further comprising a plurality of switching circuits to intermittently couple the input terminal and the output terminal, wherein each clock cycle the digital controller receives a second digital feedback signal for each switching circuit and generates a control signal for that switching circuit, each second digital feedback signal derived from a current passing through an associated switching circuit.

37. A method of operating a voltage regulator having an input terminal to be coupled to an input voltage source and an output terminal to be coupled to a load, comprising:

intermittently coupling the input terminal and the output terminal with a switching circuit in response to a control signal

filtering an output of the switching circuit to provide a generally DC output voltage at the output terminal; and

operating a digital controller at a clock frequency f_{clock} which is significantly faster than a desired switching frequency f_{switch} of the switching circuit;

receiving a first digital feedback signal derived from an output voltage at the output

terminal in the digital controller each clock cycle;

receiving a second digital feedback signal derived from a current passing through the switching circuit in the digital controller each clock cycle; and

generating the control signal with the digital controller to control the switching circuit so that the output voltage is maintained at a substantially constant level.